

d.) computing the permittivity of the test sample by applying the defined permittivity coefficients to the difference between the output parameters.

5. (New) The method of claim 4 wherein the detection structure comprises a detector, a resonant structure, or a non-resonant structure.

6. (New) The method of claim 4 wherein the output parameters produced by the detector comprise circuit measurement parameters, resonant frequency measurements, and quality factor measurements.

7. (New) The method of claim 4 wherein one of the calibration samples is the reference sample.

8. (New) The method of claim 6 additionally comprising the step of measuring the complex permittivity of the calibration samples.

9. (New) The method of claim 8 wherein the measurement is made over a range of frequencies that includes the critically coupled frequency of the resonator.

10. (New) The method of claim 9 additionally comprising the step of calculating real and imaginary permittivity difference quantities.

11. (New) The method of claim 10 additionally comprising the step of

- a.) providing a resonant detector tuned to the critical coupling point of the reference sample,
- b.) electromagnetically coupling the resonant detector to a calibration sample,
- c.) obtaining the resonant detector's resonant frequency and quality factor measurements for the calibration solutions, and
- d.) applying the permittivity difference quantities to the resonant frequency and the quality factor measurements of the calibration solution to compute the permittivity coefficients.

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12. (New) The method of claim 10 additionally comprising the step of measuring resistance and reactance parameters.
13. (New) The method of claim 12 additionally comprising the step of applying the permittivity difference quantities to resistance and reactance parameters to compute the permittivity coefficients.
14. (New) The method of claim 10 additionally comprising the step of measuring real and imaginary components of an s-parameter measurement.
15. (New) The method of claim 14 additionally comprising the step of applying the permittivity difference quantities to the real and imaginary components of an s-parameter measurement to compute the permittivity coefficients.
16. (New) The method of claim 10 additionally comprising the step of measuring the permittivity of three calibration samples.
17. (New) The method of claim 16 additionally comprising the step of measuring the output parameters for the three calibration samples.
18. (New) The method of claim 17 additionally comprising the step of deriving three bilinear calibrated coefficients.
19. (New) The method of claim 18 additionally comprising the step of measuring the reflection coefficient of the test sample.
20. (New) The method of claim 19 additionally comprising the step of applying the measured reflection coefficients to the bilinear calibrated coefficients to compute the measured permittivity.